Therefore, molten metal undergoing continuous casting simply cannot respond to such high frequency vibration as is taught by the European reference, in the same way as the metal of the present invention. This is well explained in our specification, on page 13, lines 8-17, to which the Examiner's attention is directed. Thus, the results of the present invention simply cannot be obtained at vibration frequencies of the European reference.

Accordingly, our claims recite the preferred vibration frequency of 0.10 - 60Hz, except for claim 1, which recites the vibration frequency as being no greater than 65Hz. See page 38, Table 2, last line, for a disclosure of the operativeness of 65Hz.

Moreover, the European reference does not teach the electromagnets to be arranged in a facing relation on opposite sides of the mold along a transverse width thereof. Instead, each electromagnet in the European arrangement faces in the same direction, perpendicular to the open surface of the molten metal. See Figures 1-6 of the European reference. This feature further distinguishes claims 2, 5, and 10 of the present application.

As to claim 17, the European reference does not teach applying a magnetic field at positions above and below an ejection port of an immersion nozzle. In the European reference, the magnetic fields are applied only above the nozzle. Still further, the European reference does not teach the AC field moving in a longitudinally symmetrical way from opposite ends to

a center of a mold along a longitudinal width thereof. Indeed, the European reference teaches nothing about creating molten metal movement by an AC field.

Reconsideration is also requested, for the rejection of the claims as unpatentable over FUJISAKI et al. 5,746,268.

Attached hereto a Reference Table, in two sheets, which compare the present invention to a conventional technique as shown, for example, in FUJISAKI et al. As will be seen from FUJISAKI et al., in that reference there are taught a number of embodiments of arrangement of electromagnets, in which the magnetic field is applied to molten metal (see C to E in the attached Reference Table, for example). However, each such arrangement is made for creating a macroscopic flow of molten metal in the mold, according to the conventional technique (A in the Reference Table). FUJISAKI et al. teach dividing a row of electromagnets into several blocks, so as to achieve more uniform macroscopic flow.

Macroscopic flow of molten metal is favorable to the extent that molten metal is stirred, so as to avoid segregation or capture of inclusions. However, as the macroscopic flow of molten metal exists in a substantial area in the mold, it is hard to avoid local vortices or stagnation, and defects result in the cast slab by inclusion of the resulting entrainment of flux.

By contrast, in the present invention, electromagnets are arranged so as to create <u>non-moving</u> but vibrating fields. This is quite different from conventional practices such as those

of FUJISAKI et al., and results in the new and improved results pointed out in our specification.

As the claims as now presented bring out these novel and unobvious aspects of the present invention with ample particularity, it is believed that they are all patentable, and reconsideration and allowance are respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned **"Version with markings to show changes made."**

Respectfully submitted,

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Reference Table

	This invention					
Objective movement of molten metal	Stirring without macroscopic circulation flow					
	Claims 1 to 6: Vibration			Claims 9 and 10: Vibration (enhanced)		Claim 17: Laminar macroscopic flow only near "surface" (flow is weak near "center")
Magnetic Field	Non-moving / Vibrating			Non-moving / Vibrating (Static field superimposed)		Moving (toward 'center') / Vibrating (static field superimposed)
Specific examples of embodiment: Example	F	G	H	I	J	K
AC magnetic field: Type of AC	Single phase		Two phase	Single phase	Two phase	Three phase
AC magnetic field: Arrangement of electromagnetic poles (degree): Raw 1	0 /180/ 0 /180	0 / 0 / 0 / 0	0 / 90/180/270	0 /180/ 0 /180	0 / 90/180/270	0 / 60/120/(Center)/120/ 60/ 0
AC magnetic field: Arrangement of electromagnetic poles (degree): Move						
AC magnetic field: Arrangement of electromagnetic poles (degree): Raw 2	180/ 0 /180/ 0	180/180/180/180	180/270/ 0 / 90	180/ 0 /180/ 0	180/270/ 0 / 90	0 / 60/120/(Center)/120/ 60/ 0
DC magnetic field	Non			Applied superimposedly		Applied superimposedly
Note				By superimposed DC field, vibration (or flow) near "surface" is enhanced, while any flow near "center" is weakened		
Disclosure	Fig. 2, etc. / pages 10 to 13	Fig. 3, etc. / pages 10 to 13	Not disclosed	Figs. 9, 11, etc. / pages15 to 20	Not disclosed	Figs. 13, 17, etc. / pages28 to 32
Effect	Avoid inclusions due to local vortex or stagnation, etc., by stirring without macroscopic circulation flow.					Avoid inclusions due to local vortex or stagnation, etc., by stirring with macroscopic non-circulation flow only at "surface".

'center': center of the slab width direction
"center": center of the slab thickness direction
"surface": surface of the slab thickness direction

Reference Table (continued)

	Conventional Technology		Fujisaki et. Al.		
Objective movement of molten metal	Macroscopic flow to stir molten metal		Uniform macroscopic flow to stir molten metal		
	Macroscopic circulation flow	Macroscopic non-circulation flow	Macroscopic circulation flow		Macroscopic non-circulation flow
Magnetic Field	Moving / Vibrating		Moving / Vibrating (advanced)	Moving / Vibrating (Partially static)	Moving (toward 'center') / Vibrating
Specific examples of embodiment: Example	A	B	C	D	E
Specific examples of embodiment: AC magnetic field: Type of AC	Three phase	Two phase	Three phase		
Specific examples of embodiment: AC magnetic field: Arrangement of electromagnetic poles (degree): Raw 1	0 / 60/120/180/240/300	0 / 90/180/270	0 / 60/120/180/240/300	0 / 60/120/(Center)/ 〈 D C 〉	0 / 60/120/(Center)/120/ 60/ 0
Specific examples of embodiment: AC magnetic field: Arrangement of electromagnetic poles (degree): Move	→ ←	↔ ↔	→ → ← ←	→ ←	→ ← → ←
Specific examples of embodiment: AC magnetic field: Arrangement of electromagnetic poles (degree): Raw 2	300/240/180/120/ 60/ 0	180/270/ 0 / 90	0 / 60/120/180/240/300	〈 D C 〉 /(Center)/180/240/300	0 / 60/120/(Center)/120/ 60/ 0
Specific examples of embodiment: DC magnetic field	Non	Non	Non	Applied separately (different block)	Non
Specific examples of embodiment: Note			Divided into plural blocks so as to control the strength of the magnetic field separeyively		
Specific examples of embodiment: Disclosure	Fig. 4, page 12 (This Application) / Fig. 3, columns 1 to 2 (Fujisaki et. al.)	Not Disclosed	Figs. 6, 8, 9, 15, 16, 18, 20, 28, etc. / columns from 8	Fig. 60A, etc. / columns from 29	Figs. 51A to 51C, etc. / columns from 26
Effect	Avoid segregation and capture of inclusions at solidified shell, by stirring (Macroscopic flow which creates local vortex or stagnation makes above effect insufficient, and also causes entrainment of inclusions.)		Avoid segregation and capture of inclusions at solidified shell, by stirring (Same as conventional technology). Trying to achieve macroscopically uniform circulation (or non-circulation) flow. (Because of macroscopic flow, local vortex or stagnation is not sufficiently avoided, and said problems are not fully solved)		

'center':center of the slab width direction
"center":center of the slab thickness direction
"surface":surface of the slab thickness direction

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims were amended as follows:

--1. (amended) A method of continuously casting metals, comprising applying a non-moving, vibrating magnetic field having a frequency no greater than 65 Hz to a molten metal in a casting mold to impose only vibration on the molten metal.--

--13. (amended) A method of continuously casting metals, comprising intermittently applying a static magnetic field in a thickness direction of a cast slab with a frequency of 0.1 to 60 Hz.--

--19. (amended) The method according to claim 1, wherein said non-moving, vibrating magnetic field is produced by arranging electromagnets, each comprising an iron core and a coil wound over said core, in a facing relation on opposite sides of said mold along a transverse width thereof to lie side by side along a longitudinal width of said mold; and

[said] applying a single-phase AC current [has] having a frequency of 0.10 to 60 Hz, [and is applied] to each said coil.--